River Record Sheet User Guide

This user guide is intended to provide information to enable the River Record sheet to be completed as part of post project appraisal and river reconnaissance studies. It has been adapted from Thorne (1998)[1]. The methodology is explained in this document to provide a coherent set of qualitative and quantitative measures that can be used to define the river form and processes of a specific reach. Repeat reconnaissance will allow conclusions to be drawn on the response of a reach to river restoration.

The river record sheets have been simplified to allow river managers to easily complete the sections. These can then be reviewed by a geomorphologist/hydromorphologist to determine the overall river response. For review purposes, it is strongly recommended that a detailed photographic record is taken to provide evidence for conclusions drawn.

The emphasis is placed on a careful and detailed visual assessment of the study reach. Time should be taken to identify processes within the channel, on the river banks and on the floodplain. Measurements are also listed to enable channel response to be quantified where appropriate.

Tick boxes are provided where appropriate throughout the sheets to list reach characteristics. In some cases, it may be beneficial to provide a rank to each characteristic if several are present within the reach (e.g. riparian vegetation type). To do this, it is recommended to use the Braun-Blanquet Scale:

Number of individual examples present and percentage cover of Reference Area	Recorded Rank
Any number and more than 75% cover	5
Any number and 50 to 75% cover	4
Any number and 25 to 50% cover	3
Any number and 5 to 25% cover	2
Numerous but less than 5% cover, or scattered with cover up to 5%	1
A few individuals covering a small area	+
A solitary individual covering a small area	r

Note – left and right bank is with reference to looking downstream along your watercourse.

[1] THORNE, C.R., 1998. Stream Reconnaissance Guidebook: Geomorphological Investigation and Analysis of River Channels, John Wiley & Sons, Chichester, UK

Recommended field instruments to allow completion of the river record sheets are:

- Pen/pencil
- Clipboard
- Camera (with GPS if available)
- Tape measure (at least 30m)
- Sticks
- Particle size sampler (if available)

Cover Sheet (Page 1)

To be completed post audit. This provides a summary of the audit once completed, noting:

- The issues being investigated
- The significant overall findings
- The major changes since the last survey
- General conclusions and recommendations

The River (e.g. Trent), Date, Flow level (e.g. high, moderate, low) and Recorder (e.g. Mr Joe Bloggs) are also included at the top of the page.

The page should also be signed and dated once complete and reviewed by a suitable person.

River Setting and Influences (Page 2)

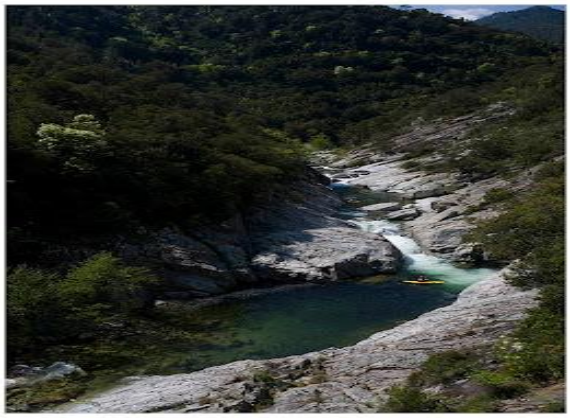
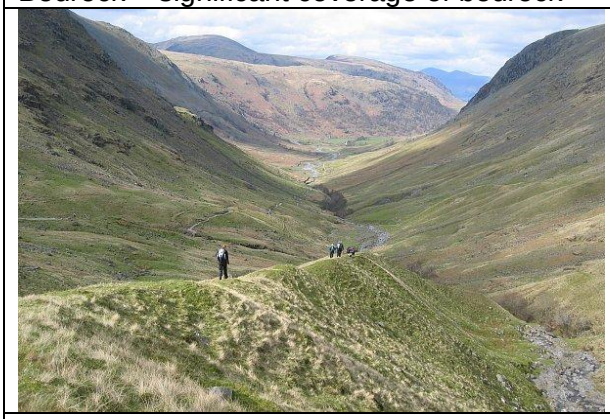
The reach start point, finish point and overall reach length are noted at the top of the page.

Box 1 - The River and Valley Setting are described through ticking the appropriate box (examples in tables below)

Terraine

Mountain	Upland
Low Hills	Lowland

Drift Type

	
Bedrock – significant coverage of bedrock	Soils – significant coverage of soils
	
Moraine – significant coverage of unconsolidated glacial debris (soil and rock)	Fluvio-glacial – significant coverage of layered soil and rock
Fluvial – significant coverage of reworked fluvial deposits (rock, soil, gravels)	Lake – significant coverage of lake deposits

Valley Type

Gorge	Confined
Narrow floodplain	Wide floodplain

River Type

Bedrock – often upland areas, little bed sediment, steep channel gradient, stable channels	Step-pool – large boulder groups forming steps separated by pools, pools contain finer sediment, steep channel gradient, stable channels
Plane bed – gravel/cobble beds, armoured bed, relatively stable channels, often straight planform	Braided – Often relatively high gradients, high bedload, channel characterised by number of threads, highly dynamic but usually during larger floods

Wandering – characteristics of braided and active meandering, smaller bed material size, shallower slope and wider valley floor, often sequences of bars, pools, riffles, rapids, runs	Active single thread / meandering – sand and fine gravel dominated, low gradient channel, often dynamic channels, better connected floodplains, bars, pools and riffles common
Passive single thread / meandering – low gradient, often resistant bed and banks (e.g. clays), less dynamic but sinuous planform, often incised, glides dominate	

Box 2 - The River Influences are described through ticking the appropriate box. This determines both catchment and local scale influences in terms of:

1. Land Use – whether the dominant surrounding land use is natural, pasture, arable, urban or suburban

2. Sediment delivery – whether the sediment inputs to the study reach (from all sources) is generally a strong, moderate or low coarse or fine supply

3. Flow – whether the general flow characteristics of the reach are high energy flashy (often high gradient, quick to respond to rainfall), moderate energy flashy, moderate energy subdued (less responsive to rainfall, longer time to peak), low energy subdued (often lower gradient, less responsive to rainfall) or low energy invariant (flow is generally low energy and unchanging)

4. Engineering – tick appropriate box where any of these engineering schemes are present within the study reach: hard banks (e.g. concrete or brick), hard bed (e.g. concrete or brick), weir, dam, groynes/deflectors, bridge crossing, re-sectioned,

straightened, dredges, embanked distant (i.e. set bank from banks) or embanked adjacent (i.e. on river banks)

5. Riparian vegetation – is the vegetation within the riparian corridor generally unimproved grassland, improved grassland, arable, scrub, deciduous forest, coniferous forest, mixed forest, or other/none

6. Riparian land use – is the land use within the riparian corridor (this is different to land use above which describes the wider catchment land use) natural, pasture, arable, urban or suburban

There is also a sketch box available to note any significant features or influences

River Character (Page 3)

Box 3 – This begins to describe the River Characteristics locally within the reach in terms of sediment characteristics and morphological units, which can then be related to the flow type characteristics on page 3 to define the hydromorphology of the reach. Time should be taken in undertaking a thorough visual assessment and compiling a detailed photographic record for audit and review purposes.

Bed sediment – is defined by it being boulder dominated, boulder with cobbles, cobbles, cobbles with gravels, gravels, gravels with fine sediment (this may be in the form of fine sediment infilling gravels) and then fine sediment dominated. In additions, there may be a veneer of fine sediment across the top of gravels, or a ripple/dune feature (associated to fine sediment dominated beds).

Morphology – example morphological units are given in the table below to help define the appropriate features within the reach.

Morphology

Pool – deeper sections of river, less energetic flows, shallow gradient, finer bed material than riffles	Plane bed - invariant bed and flow type, often gravels and some cobbles, shallower than pools

Riffle – shallower sections of river, energetic flows, moderate gradient, coarser bed material/gravels	Rapid – steep gradient, coarse bed material (cobbles, possibly small boulders), energetic/turbulent flows
Boulder step – boulder bed material, steep gradient, energetic/turbulent flows	Transverse bar – Extension of lateral side bar towards the centre of the channel, composed of cobbles, gravels or fines
Island – created through bifurcating flow around a stabilised section of bank, well vegetated, mixed sediment composition	Lateral bar – deposition on one bank of the channel, mixed sediment composition

Point bar – deposition on inside of bend associated to bank erosion on opposite bank, composed cobbles, gravels and fines	Mid-channel bar – deposition in the centre of the channel becomes stabilised through infilling and vegetative colonisation, mixed sediment composition
Confluence bar – deposition at confluence of two watercourses, often creating a splay across the mouth of the adjoining river, mixed sediment composition	Chute – channel cut through a bar deposit, created at times of higher flows, varying channel sizes
River cliff – steep bank, often on the outside of a bend, created by erosion of the bank toe and bank collapse leaving a bare, steep face	Berm – a flat, small in-channel deposit, often lateral, often fine sediment dominated in lowland watercourses

Floodplain features – e.g. paleo channels	

Box 4 – The river flow types and associated bed and bank activity and are recorded in this section. The results of this should be closely linked to the morphological unit analysis on page 2. Again, time should be taken in undertaking a thorough visual assessment and compiling a detailed photographic record for audit and review purposes.

Flow types – example flow types are given below in the table below to help define the appropriate biotopes within the reach.

Flow types

Cascade – energetic flow type, turbulent, could include a small vertical drop	Chute – energetic, turbulent flow, often over boulder or bedrock

Riffle – often symmetrical ripples are created, not waves, shallow water depth, less turbulent flow	Run – fewer ripples than riffles, less turbulent
Glide – deeper, slow flowing, little water surface disruption	Pool – deep, slow flowing, no water surface disruption

Bed and Bank Activity – the movement of the channel bed is characterised in this section, as well as any evidence of bank erosion/failing or stabilisation, with the following options:

1. Stable bed – bedrock or boulder dominated; infilled/consolidated gravels; consolidated cohesive bed
2. Mobile fines – unconsolidated fine sediment (e.g. sand and silts), could be characterised by ripples/dunes
3. Mobile gravels – clean gravels on bar features, look for fresh gravel deposits.
4. Mobile bed – general mobile bed, little fine sediment infilling, recent evidence of movement
5. Armoured bed – coarse bed material creates a protective layer across an unconsolidated bed providing some stability at moderate flows
6. Active bars – evidence of clean gravel deposits on bar features, little vegetative colonisation
7. Inactive bars – heaving fine sediment infilling of gravel bar features, well vegetated

8. Outer bank erosion – fluvial erosion of the outer bank, which could trigger bank collapse
9. Inner bank erosion – fluvial erosion of the inner bank
10. Erosion of both banks
11. Shoaling/riffle development – is there significant accumulation of gravels on the channel bed that is creating shallower, rippled flow
12. Bar/island creation – has in-channel deposition created bars or islands
13. Bar/island bank erosion – is there evidence of erosion of in-channel deposits or islands
14. Bar dissection – has bar erosion dissected a channel through the deposit
15. Chute development – has bar or bank erosion developed into a chute channel that reconnects into the main channel
16. Overbank gravel splays – look for evidence of overbank gravel deposition, particularly after a flood event
17. Avulsion – has the channel bed or bank changed completely following a significant flood event, changing from one channel or feature type to another

Box 5 – The river bank types and processes are analysed in this section, with a separation between left and right bank characteristics. Again, time should be taken in undertaking a thorough visual assessment and compiling a detailed photographic record for audit and review purposes.

Bank types

Uniform alluvial	Uniform gravel supported

Alluvial over gravel	Cantilever failure – basal scour of non-cohesive sands/gravels which underlay a cohesive layer, creates overhang which then fails at a critical state
Rotational slips – slumping of the river bank over a concave face, can be created by bank toe erosion and/or steepening	Slipped blocks – similar to rotational slips but does not occur along a concave face, more of a vertical slip

There is also a sketch box available for detailing any notable characteristics of the particular study reach.

Riparian Vegetation Character (Page 4)

Box 6 – This describes the riparian vegetation over the left bank, right bank and on any in-channel islands, bar or berms. A photographic record is also recommended for conclusions drawn in this section. The options are:

1. Bare – little to no vegetation, a potential indicator of grazing pressures, or active banks/in-channel deposits
2. Sparse annual/grasses – some low growing vegetation, may be subject to grazing pressures
3. Dense annual/grasses – providing some significant stabilisation to the banks or in-channel feature
4. Mixed scrub – greater stabilisation provided by root networks
5. Scrub/trees – significant root networks provide strong stabilisation to the banks or in-channel feature
6. Plantation – unnatural planting of scrub and trees
7. Single line – a single row of scrub or trees lining the banks
8. Narrow belt – 2 to 4 rows of scrub or trees
9. Wide belt – Greater than 4 rows of scrub or trees

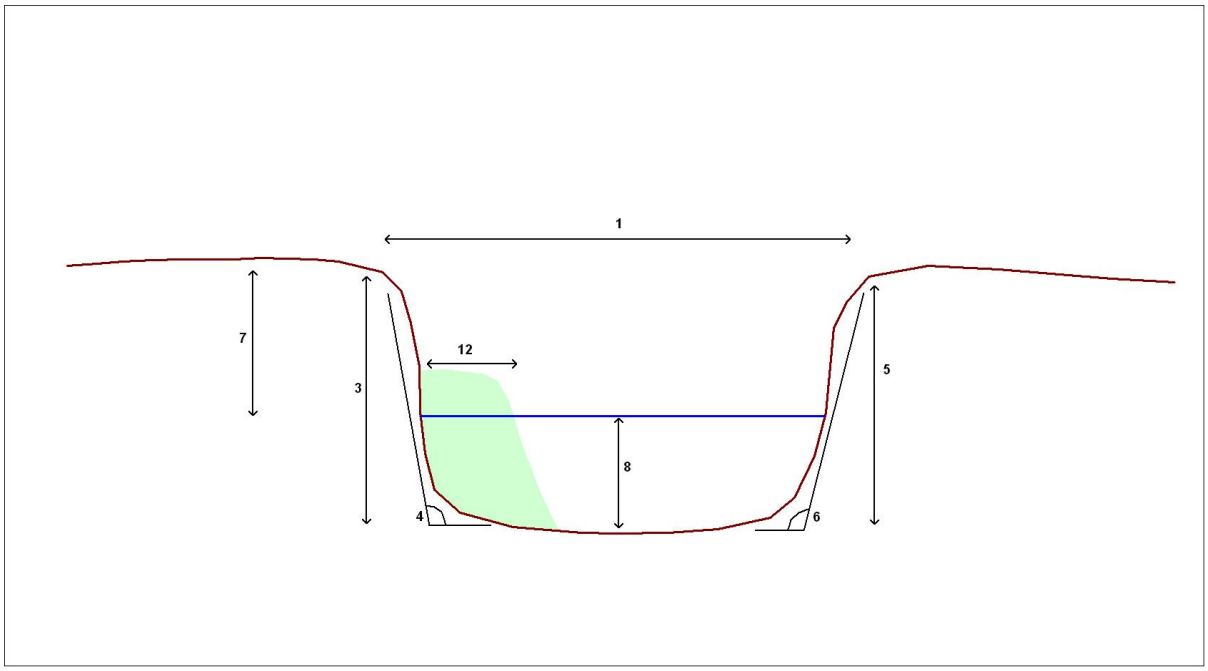
Geometry - Quantification (Page 5)

This page provides a means to record important quantitative measures of the river reach that can be tabulated and compared to following subsequent audits/post project appraisal. Numerous copies of this page can be made to record a suitable amount of detail for your reach depending on the reach length.

The parameters than can be measured include:

1. Top width (right bank top to left bank top in metres)
2. Local width var (channel with variation within the reach in metres)
3. Left bank height (in metres)
4. Left bank angle (approximation in degrees)
5. Right bank height (in metres)
6. Right bank angle (approximation in degrees)
7. Floodplain elevation above water (level difference between water surface level and floodplain level, in metres)
8. Average flow depth (along the study reach in metres)
9. Depth variability (e.g. at riffle and pools, in metres)
10. Mean surface velocity (throwing a stick in the water to estimate is suggested at different location, in metres per second)
11. Maximum surface velocity (quickest stick test, in metres per second)
12. Bar width (across the channel, in metres)
13. Bar length (along the channel, in metres)
14. Berm width (across the channel, in metres)
15. Berm length (along the channel, in metres)
16. Bed sediment D50 (size at which 50 per cent of the sample is less than)
17. Bed sediment D95 (size at which 95 per cent of the sample is less than)
18. Bar sediment D50 (size at which 50 per cent of the sample is less than)
19. Bar sediment D95 (size at which 95 per cent of the sample is less than)
20. Berm sediment D50 (size at which 50 per cent of the sample is less than)
21. Berm sediment D95 (size at which 95 per cent of the sample is less than)

Diagrams of some of the physical measurements that can be taken are shown below.



There is also a sketch box available to produce an indicative sketch of the study reach, to note any particular features or changes.